REMARKS

Interview Report

The Examiner is thanked for his careful and courteous attention in the telephone interview with the undersigned on December 15, 2011. During the interview, the rejections under 35 USC 112 were discussed. The undersigned agreed that there was no strict verbal basis for the references in claims 40, 50 and 55 to an auxiliary outlet and inlet and proposed that these references should be replaced by a reference to a requirement that the access of gas to the auxiliary chamber and to the closed chamber of the module were controlled in different ways, as disclosed on page 15, lines 16-17 (paragraph 0042). The examiner agreed that this could be done. The Examiner also agreed that the reference to various features as "auxiliary" was merely a convenient form of identifying the features in question, and could therefore be retained. With regard to the references to the auxiliary closed chamber being different from the closed chamber of the module, the undersigned directed the Examiner 's attention to the fact that paragraphs 0041 and 0042 referred to closed chambers in general, not only to closed chambers in modules, and that paragraph 0016 makes it clear that it is merely a preferred feature that the internal ACM is part of a module. The Examiner did not disagree with the undersigned's argument that this disclosure in the specification provided basis for those references in the claims, but wished to give the matter further consideration before making a decision.

Amendments to the Specification.

¶ ¶ 0033 and 0042 have been amended to correct minor clerical errors.

Amendments to the Claims

Claims 40, 50 and 55 have been amended in view of the rejections under 35 USC 112, and some consequential amendments have been made in other claims. It is believed that the wording of these claims now precisely reflects the disclosure in paragraphs 0041-0042, in particular page 15, lines 15-21. In addition, claim 40 has been rewritten in independent form.

In addition, it has been noted that there was an error in the previous Amendment, in that there are no claims 53 and 54. Previous claims 55-60 have been renumbered as claims 53-58 in order to correct this error.

These amendments have been made in the interests of speedy prosecution, and without prejudice to Applicant's right to prosecute different claims in one or more continuing applications.

It is believed that these amendments are clearly permissible at this stage of prosecution, since they are made in answer to a rejection by the Examiner and do not raise any new issues. If by any chance, the Examiner thinks that the amended claims fail to comply with the written description requirement 35 USC 112, it is respectfully requested that the Examiner should call the undersigned, so that further amendment can be made in order to place the application in condition for allowance, or in better condition for any appeal that may be necessary.

The Rejection under 35 USC 112

Applicant respectfully traverses the rejection of claims 40, 50 and 55- 56 under 35 USC 112, insofar as that rejection is applicable to the amended claims. As noted above, it is believed that the amendments will overcome this rejection.

The Rejections under 35 USC 103.

Applicant respectfully traverses the rejections under 35 USC 103 of

(1) claims 17, 22, 30-32, 34, 35 and 45 over Marcellin in view of US 6,256,905 (hereinafter referred to as "White"),

(2) claims 18, 44 and 46 over Marcellin in view of White, and in further view of US 5,801,317 (hereinafter Liston),

(3) claims 23, 33, 36, 38, 47 and 48 over Marcellin in view of White and in further view of US 6,376,032 (hereinafter "Clarke 032"),

(4) claim 24 over Marcellin and White, in further view of Clarke 1 and US 6,013,293 (hereinafter "DeMoor"),

(5) claims 25-28, 39 and 49 over Marcellin in view of White as applied to claim 17, 34 and 45, and in further view of Clarke 032, DeMoor and US 4,949,847 (hereinafter "Nagata"),

(6) claims 40-42, 50-52, 55 and 57-60 over Marcellin in view of White,

(7) claims 40-42, 50-52, 55 and 57-60 over Marcellin in view of White and in view of US 6,007,603 (hereinafter "Garrett") and DeMoor,

(8) claim 43 over Marcellin in view of White, Garrett, Clarke 032 and DeMoor and in further view of US 2002 0127305 (hereinafter Clarke 305), and

(8) claim 56 over Marcellin in view of White, or Marcellin in view of White, Garrett, and DeMoor, either or both in further view of Clarke 032,

insofar as those rejections are applicable to the amended claims, for the following reasons.

All the rejections are based upon a combination of Marcellin and White, all but the first with additional references. As explained below, Applicant believes that one of ordinary skill in the art would not have considered combining Marcellin and White, and that the Office Action reflects a misunderstanding of the disclosure in White. Applicant believes, therefore, that all the rejections should be withdrawn. Under these circumstances, this response does not discuss all of the rejections. Insofar as this response does not discuss any of the rejections, this is not an admission that Applicant agrees with any of those rejections or any of the arguments put forward in support of those rejections. On the contrary, applicant believes that many of the arguments put forward in the Office Action are not reasonable, and Applicant reserves the right to contest any of those arguments in this or continuing applications.

(1) The rejection of claim 17, 22, 30-32, 34, 35 and 45 over Marcellin in view of White.

This rejection, and all the other rejections, rely upon Marcellin in view of White. However, as will be shown below, White is concerned with a technology which is distinctly different from the technology of the present invention and

Marcellin. One of ordinary skill in the art would not, therefore, combine White with Marcellin, or otherwise consider the disclosure of White useful for the modification of Marcellin.

The present invention, and Marcellin, relate to a technology in which a packaging atmosphere (i.e., an "inner atmosphere" which surrounds a respiring biological material) within a sealed container is controlled through the use of a closed chamber which is within the sealed container and which is contacted by the packaging atmosphere. The control is achieved by the passage of gases (principally oxygen and carbon dioxide) through part or all of the walls of the closed chamber. The packaging atmosphere is on one side of the walls of the closed chamber and an outer atmosphere is on the other side of the walls of the closed chamber. The outer atmosphere is passed through the closed chamber. In the simplest case, the outer atmosphere is air, but it can be, for example, oxygen-enriched air. The packaging atmosphere is controlled because of the difference in the partial pressures of oxygen and carbon dioxide in the packaging atmosphere and in the outer atmosphere. Since the respiring biological material consumes oxygen and produces carbon dioxide, oxygen passes from the outer atmosphere into the packaging atmosphere, and carbon dioxide passes from the packaging atmosphere into the outer atmosphere. The permeability of the walls of the closed chamber must be such that a suitable amount of oxygen can enter the packaging atmosphere and a suitable amount of carbon dioxide can leave the packaging atmosphere. By selecting walls having the correct permeability, the desired packaging atmosphere is produced within the sealed container. In some cases, it is difficult or impossible to obtain the desired permeability using walls composed of the materials which are conveniently used for the construction of a closed chamber. For example, metal walls are essentially impermeable to gases, and simple polymeric walls have insufficient permeability and/or an unsatisfactory ratio of carbon dioxide permeability to oxygen permeability (the R ratio). In such circumstances, part or all of walls of the closed chamber are composed of a specially selected material, for example a porous substrate having a polymeric coating thereon.

White is concerned with a completely different way of producing the desired packaging atmosphere within a sealed container containing a respiring biological material. There is no closed chamber within the sealed container. Instead, the desired packaging atmosphere is injected directly into the sealed container. For this purpose, the sealed container must have an inlet through which the desired packaging atmosphere can be passed, and an outlet so that pressure does not build up within the sealed container. White uses the term "shipping unit" to describe the sealed container with the inlet and outlet (see for example the Abstract). A number of the shipping units can be placed inside a conventional shipping container, together with the gas-producing apparatus needed to generate the controlled atmosphere which is injected into the shipping units (see, for example, the Figures).

The rejections are based upon a misreading of White. Thus the Office Action states, on pages 5-6: –

> *... White teaches regulating gas within the shipping container, where the shipping container can comprise respiring foodstuffs (see figure 1A, 1B and 16 and, 9, lines 12-14) and where a gas regulating device has also been placed into the container (see column 9, lines 28-57 and also see column 15, line 62 to column 16, line 44). White is similar to Marcellin since White also employs "modules" for the purpose of controlling the atmosphere within a container for preserving foodstuffs such as respiring foodstuffs.*

This summary of White ignores the critical distinction between White's "shipping units" and the shipping container into which a number of shipping units are placed. White places a gas regulating unit within the shipping container, but **not** within the "shipping unit". Furthermore, White's gas regulating unit is quite different from the "module" required by the claims. White does **not** employ a module having a first surface in contact with the inner atmosphere (the packaging atmosphere) and a second surface in contact with an exteror atmosphere, as required by the claimed invention. White employs a gas-regulating unit which is outside the sealed container containing the respiring biological material (the shipping unit), and which simply injects a desired atmosphere into the shipping unit. White's technical approach is entirely different from Marcellin and the invention.

One of ordinary skill in the art would not, therefore, regard White as a useful source of information for the modification of Marcellin. If, for the sake of argument, it is supposed that one of ordinary skill in the art modified Marcellin in accordance with White's teaching, the result would be to do away with Marcellin's internal "battery" and simply to inject the desired atmosphere into the cold room. That would of course be directly contrary to Marcellin's teaching, and result in an apparatus and method entirely different from the claimed invention.

It is submitted, therefore, that all the rejections under 35 USC 103 must be withdrawn.

2. The Rejection of Claims 18, 44 and 45 over Marcellin in view of White and Liston.

This rejection relies on Liston to make good Marcellin's failure to disclose sensors and pressure generating means as in claims 18, 44 and 45. It does not do so. Liston suffers from the same deficiency as White, i.e. it discloses a system which injects a gas of desired composition into a sealed container, and does not disclose a module of any kind within the sealed container. Liston differs from White in that the gas which is injected into the sealed container is prepared by passing air through a gas separation means comprising a plurality of hollow fiber membranes -- see for example, column 6, lines 42-62, and Figures 3-8 and the description of them. There is no module of any kind within the sealed container and the hollow fiber membranes are not exposed to the gas surrounding the product in the storage facility.

One of ordinary skill in the art would not, therefore, combine Liston with Marcellin, or otherwise consider the disclosure of White useful for the modification of Marcellin. If, for the sake of argument, it is supposed that one of ordinary skill in the art modified Marcellin in accordance with the teaching of White and Liston, the result would be to do away with Marcellin's internal "battery" and simply to inject the desired atmosphere into the cold room. That would of course be directly contrary to

Marcellin's teaching, and result in an apparatus and method entirely different from the claimed invention.

2. The Rejection of Claims 40-42, 50-52, 55 (now renumbered 53) and 57-60 (now renumbered 55-58) over Marcellin in view of White, Garrett, Clarke 032 and DeMoor

Garrett is relied upon to make good the failure of the combination of Marcellin and White to disclose an auxiliary closed chamber which is different from the closed chamber of the module and which is otherwise as defined in claim 40. Clark's 032 and DeMoor are relied upon for the disclosure of an ACM in the auxiliary closed chamber having a R ratio of 1-2.3.

The operating principle of Garrett's system is entirely different from that of Marcellin and the present invention, in which an atmosphere control member having a large surface area is directly exposed to the atmosphere surrounding the respiring biological material.

Garrett makes use of semipermeable membranes through which different gases diffuse at different speeds. As Garrett notes at column 1, lines 35-58, the semipermeable membranes for gas separation are well known and contain "a multitude of identical elongate hollow fibers which are formed from a suitable semipermeable membrane, and which extend in parallel to one another". The mixture of gases which is to be treated enters one end of the hollow fibers, and as the mixture progresses along the length of the fibers, one or more of the gases diffuse through the semipermeable walls of the fiber, and the mixture of gases in the interior of the hollow fiber becomes richer in the retained gas and poorer in the gases that diffuse through the wall of the fiber. Garrett makes use of a first module in which the semipermeable membranes retain nitrogen and permit passage of oxygen, carbon dioxide, ethylene and water vapor. A nitrogen-rich product gas issues from the end of the fibers and is returned to the atmosphere surrounding the respiring biological materials. A nitrogen-depleted product gas, which has passed through the walls of the fibers, is passed to a second separation module. The second separation module produces a first product gas which has passed through

the semi--permeable walls of the hollow fibers, and a second product gas which issues from the ends of the hollow fibers. The first product gas, containing carbon dioxide and water vapor, is returned to the packaging atmosphere. The second product gas, principally oxygen and ethylene, is vented to the environment.

One important fact about such modules which is not expressly stated in Garrett is that each of the modules must be completely enclosed except for an inlet and two outlets, one outlet for the gases which permeate through the semipermeable membranes and the other outlet for the gases which emerge from the ends of the semipermeable walls of the hollow fibers. Attached are two publications, downloaded from the web, which provide further details about such modules, in particular illustrations showing that the module is completely enclosed except for the inlet and the two outlets. Indeed, that is necessary in order to keep in place the semipermeable membranes, which must be very thin in order to carry out their gas separation function.

For the sake of completeness, it should be noted that the semipermeable membranes disclosed by Garrett are not atmosphere control members having a surface area greater than 0.65 m². The term atmosphere control member is used in this specification, as defined in paragraph 0033 on page 11 (with the minor correction shown), as

> *any member which modifies the rates at which oxygen and carbon dioxide pass into and <u>out of</u> ~~out~~ a sealed container, and which thus insures that the atmosphere within the container is different from the ambient atmosphere surrounding the container, which is usually air, but can be a controlled atmosphere other than air.*

Even if Garrett's semipermeable membranes can properly be regarded as atmosphere control members, which is to be doubted, even the semipermeable membranes in the first module do not have a surface area greater than 0.65 m² in direct contact with the atmosphere surrounding the respiring biological material. It is true that the hollow fibers of the first module are initially in contact with the atmosphere surrounding the respiring biological material, but that rapidly ceases to be true as the oxygen, carbon dioxide, ethylene and water vapor diffuse through the walls of the hollow fiber. Consequently, no matter how many fibers there are in the

module, the area which is in direct contact with the atmosphere surrounding the respiring biological material is much less than the minimum of 0.65 m^2 required by the claims for the ACM in the module.

The Office Action states, on page 21, emphasis added

> ... the atmosphere control members of the second chamber of Garrett **have a first surface in direct contact with the atmosphere of the respiring biological material** and a second surface that is not in direct contact with the atmosphere of the biological material (since the second surface is inside the closed chamber) and thus is exposed to the atmosphere passed into the chamber.

As will be clear from the summary of Garrett above, and the fact that the module is completely enclosed except for the inlet and the two outlets, that statement is not correct. Neither of the surfaces of the semipermeable walls of the hollow fibers in the second module is at any time in direct contact with the atmosphere surrounding the respiring biological material. The gas which is fed into the second module is the nitrogen-depleted product stream from the first module. Consequently, at the entry point, the atmosphere which is in contact with the inner surface of the hollow fibers is the nitrogen-depleted product stream from the first module, and as the gas stream progresses along the interior of the hollow fiber, it becomes richer in oxygen and ethylene and poorer in carbon dioxide. The atmosphere which is in contact with the outer surface of hollow fibers is the mixture of gases which has diffused through the walls of the hollow fibers. The drawings in White are misleading in this respect, since they do not show that there is an impermeable wall which surrounds the array of hollow fibers. It is no doubt this fact which caused the Examiner to conclude, incorrectly, that the outer surface of the semipermeable membranes in Garrett's second module have a surface which is in direct contact with the atmosphere of the respiring biological material. If in fact the outer surface of the semi permeable membranes was in direct contact with the packaging atmosphere, then the desired permeation of gases through the semipermeable membranes would not take place.

The Office Action continues (emphasis added)

> *Therefore, to modify Marcellin, as taught by Garrett,* ***who is also employing a similar permeation technique*** *for controlling the atmosphere*

within the container and to also include another auxiliary closed chamber, as taught by Garrett would have been obvious to one having ordinary skill in the art, for the purpose of being able to further control the gas composition returned back into the inner atmosphere which might not have been completely removed via the primary module.

As pointed out above, Marcellin and Garrett use very different techniques. Furthermore, this assertion ignores the fact that the auxiliary ACM must have a surface which is in direct contact with the atmosphere surrounding the respiring biological material. Claim 40, and the claims with similar limitations, are not directed to a system in which the output from a first module is then passed to a second module. In that case, the ACM in the second module would not be in direct contact with the atmosphere surrounding the respiring biological material.

It is also noted that DeMoor and Clark 032 use a technique which, like the technique used by Marcellin, is very different from the technique used by Garrett.

For the sake of completeness, it is noted that claims 42, 52 and (renumbered) 56, require that the auxiliary ACM comprises a porous sheet material which does not have a polymer coating thereon, the porous sheet material being a nonwoven fabric or a microporous film. These claims are yet further distinguished from Garrett, since such materials would be wholly unsuitable for use in Garrett's system.

It is submitted that the rejection of Claims 40-42, 50-52, 55 (now renumbered 53) and 57-60 (now renumbered 55-58) over Marcellin in view of White, Garrett, Clarke 032 and DeMoor should, therefore, be withdrawn.

The Provisional Double Patenting Rejections.

Since it is not clear what claims will be allowed in this application or in co-pending application 11/989,513, Applicant will give proper consideration to these rejections when it is clear what claims will be allowed in the two applications.

Conclusion

It is believed that this application is now in condition for allowance, and such action at an early date is requested. If, however, there are any remaining objections or rejections that could usefully be discussed by telephone, the Examiner is asked to call the undersigned.

Respectfully submitted,

THP Richardson

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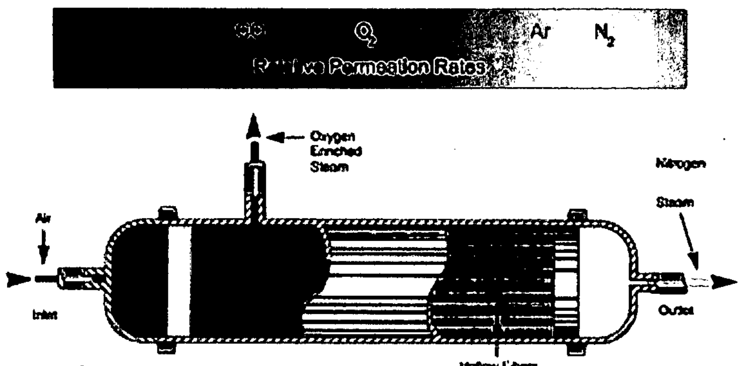
Nitrogen Gas Separation

How membrane separation works.



PRISM® membrane separator

The air that we breathe contains 78 % nitrogen, 21 % oxygen and 1 % other gases.The Air Products membrane separators uses this unlimited supply of raw material to produce specific purities of nitrogen.

Selective permeation is the general principle behind the membrane system. Each gas has a characteristic permeation rate thas is function of its ability to dissolve and diffuse through a membrane. This characteristic allows "fast gases" such as oxygen to be separated from "slow gases" such as nitrogen.

The key components of the nitrogen generators systems are the Air Products **Prism** ® membranes modules. Each module contains thousands of hollow fiber membranes wich allow the oxygen, water vapor and carbon dioxide in compressed air to be selectively removed resulting in nitrogen-rich product stream. By adjusting the air flow rate through the membrane module, different nitrogen purities and flow rates can be produced.


From our testfacilities.All generators are function/performance tested prior to delivery


Assembly line for Offhore Nitrogen Generators


Assembly line for Marine Cabinet model NC-1

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Gas separations by membranes
Air Products Norway is the world leader in nitrogen gas separations by membranes, and applies its proprietary technology in a variety of Air Products PRISM® membranes.

Nitrogen Gas Separation
How membrane separation works.

Company News
December 7, 2006
Air Products' Membrane Manufacturing Facility Expanding to Meet Growing Demand

Operation of the nitrogen membrane generators are simple.First, particulates, water and oil in compressed air are removed by coalescing/particle filters.The air is then fed into the **Prism** ® module separators wich separate the nitrogen from other gases. As the pressurized air flows into the hollow membrane fibers contained in the separators, faster gases (oxygen,water,carbon dioxide) permeate through the fiber walls, are collected, then vented to the atmosphere. The slower, non-permeate gas (product) exits from the other end of the separator. The **Prism** ® membrane module maximizes separation efficiency by maximizing the membrane surface area in a compact space.

The photo shows the assembly location of Air Products Norway. Membrane modules installed on various nitrogen generator systems.

Ref: HI-0 (12.03.07)

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Technology
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GRASYS

Products Services Gases

Nitrogen plants and stations

Oxygen plants and stations

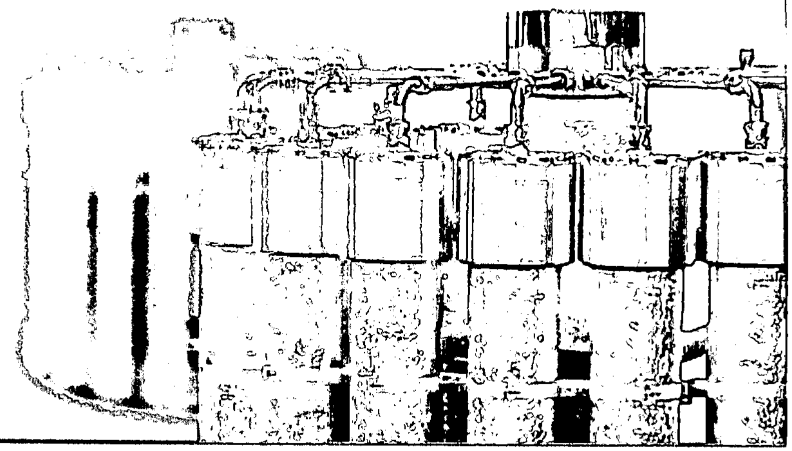
Cryogenic plants for nitrogen, oxygen and argon production

Nitrogen fire fighting units

Modular compressor stations

Hydrogen plants

Hydrocarbon plants (associated petroleum gas treatment)



Main › Technologies › Membrane technology

Technologies

Membrane technology

Adsorption technology

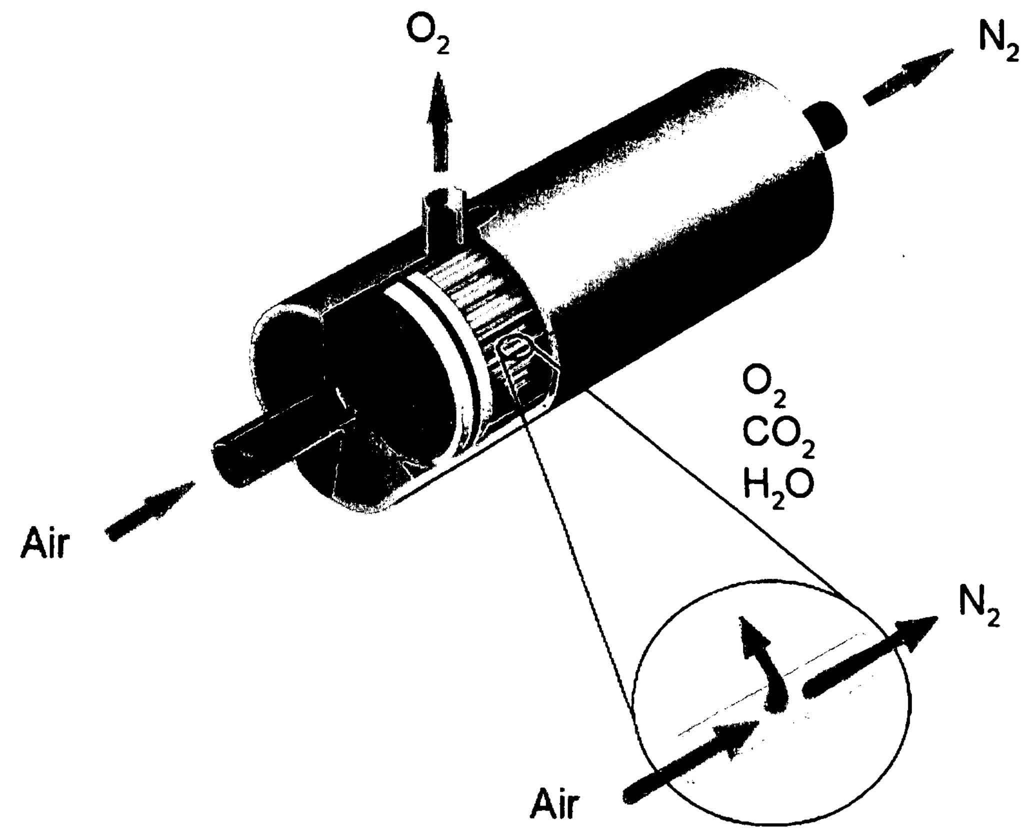
Cryogenic technology

Membrane technology

The pivot of the membrane technology is the membrane responsible for the gas separation proce
no longer represents a flat plate or film, but is shaped as hollow fibers.
Membrane separation technologies currently use a hollow-fiber membrane consisting of porous p
A porous fiber has a complex asymmetric structure, with the polymer density increasing towards t
of porous support layers with asymmetric structure allows separating gases under high pressures
gas separation layer does not exceed 0.1 μ, ensuring a high relative permeability of gases across
of the technological development makes possible the production of polymers with a high selectivi

capable of deliveringhigh-purity gaseous products. A modern membrane module used for the me gas separation technology comprises a removable membrane cartridge and a body. The density packaging in the cartridge is estimated at some 500–700 square meters per the cartridge cubic m which helps to minimize the dimensions of gas separation plants.

Schematic Drawing of Gas Separation Cartridge



The module body has one inlet pipe for feed gas mixture intake, and two outlet pipes for delivery

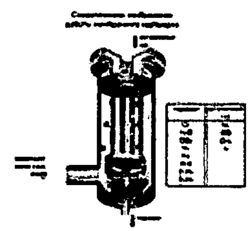
The membrane technology based gas mixture separation utilizes the difference in partial pressur of a hollow-fiber membrane. Highly permeating gases (e.g. H_2, CO_2, O_2, water vapors, higher hyd membrane cartridge through one of the pipes. Less permeating gases (e.g. CO, N_2, CH_4) exit the pipe.

Gas Penetration Rate through Membrane Materi

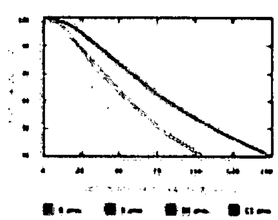
Fast gases

H_2O	He	H_2	NH_3	CO_2	O_2	CO	Ar	N_2

Membrane Based Gas Separation Process



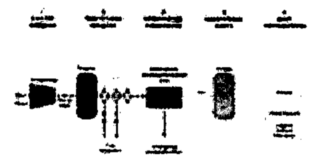
Schematic presentation of the membrane cartridge operation



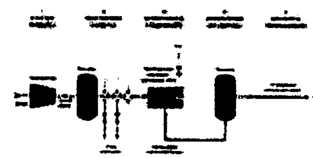
Dependence of the membrane module capacity on the nitrogen pu

Dependence of the nitrogen purity on the membrane module inlet

Flow Diagram of Membrane Plants Operation

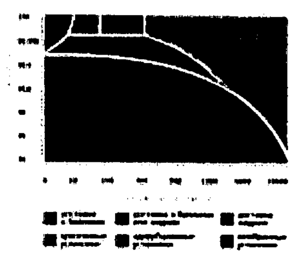


Membrane nitrogen plant

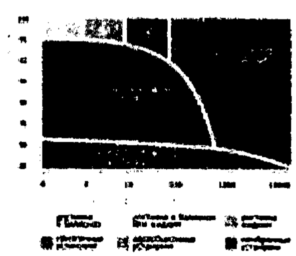


Membrane oxygen plant

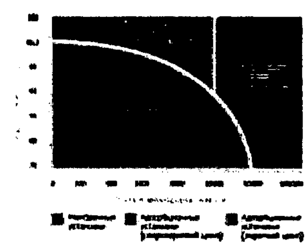
Economic Expediency of Membrane Technology Applic



Economic expediency of the membrane technology application for



Economic expediency of the membrane technology application for



Economic expediency of the membrane technology application for

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